

Frequently Asked Questions About HOV Lane Safety

This document provides the answers to frequently asked questions about the role of safety in planning, designing and operating high-occupancy vehicle (HOV) facilities. Questions regarding high-occupancy toll (HOT)-facility safety and opportunities for further HOV and HOT safety research are also addressed. The document was prepared as part of the HOV Pooled Fund Study project, which included development of the *HOV-Lane Safety Considerations Handbook*. The following questions and answers are targeted to transportation professionals responsible for various aspects of planning, designing, implementing, operating, managing, and monitoring HOV and HOT facilities. Agency management personnel, policy makers, and other individuals interested in HOV and HOT-facility safety may also find this document and other project information of benefit.

HOV Safety Considerations FAQs

1) What is HOV-lane safety?

HOV-lane safety is a concept that describes in quantitative or qualitative terms the propensity for users of the facility to be involved in crashes resulting in bodily injury. The safety of HOV lanes is often expressed quantitatively as crash rates to enable valid comparisons over time and between facilities. For the purposes of this project, HOV-lane safety considerations encompass planning elements, policies, actions, design standards, treatments, and operational practices employed by agencies to reduce the number and consequences of HOV-lane crashes and incidents. Many of these considerations are also applicable to HOT facilities.

2) Why is HOV and HOT safety important?

Motor vehicle crashes remain the leading cause of death for children and young adults in the United States. Thousands of crashes occur each year on HOV and HOT facilities. Worsening traffic congestion and an expanding population of elderly drivers underscore the importance of continued road-safety analysis and improvement. This is particularly true with respect to burgeoning HOV and HOT networks, whose operations are affected by congestion and can present complex driving situations to motorists. Consideration of safety issues in the development of HOV and HOT facilities results in:

- Fewer inappropriate facility locations, types, designs, and operations
- Reduction of inherently unsafe conditions on and around facilities

- Prevention of crashes and related deaths, injuries, and property damage

3) What are the primary challenges to enhancing safety on these facilities?

Safety is one of many concerns competing for limited resources and attention in the development and operation of transportation facilities. Costs, physical constraints, and operational issues may preclude adoption of the “safest” facility type, design or practice in a given circumstance. In some cases, mobility and safety goals conflict in the development of HOV and HOT facilities. In other instances, data and information required to draw conclusions regarding causative factors in crashes are not available or have not been collected. This has frustrated some attempts to identify and mitigate hazards, and occasionally led to inconclusive or contradictory findings with respect to the safety of implications of specific HOV-lane policies and treatments. Addressing HOV and HOT safety research needs, gaps and opportunities is important in overcoming these obstacles.

4) What are some of the key safety considerations in HOV-lane planning, design, and operations?

The following is a concise list of key safety considerations in HOV-lane planning, design, and operations:

- Planning:
 - Safety Goals and Objectives
 - Safety Measures of Effectiveness
 - Safety Data Requirements
- Design:
 - Facility Cross Section
 - Techniques for Separation of Traffic Flows
 - Access Treatments
 - Signage
 - Enforcement Sites
- Operations:
 - Lane Opening, Closing, Reversal
 - Incident Management
 - Enforcement Operations
 - Data Collection

5) Who should be involved in HOV planning as it relates to safety?

The following stakeholders are principal entities that have safety-related responsibilities in HOV planning. It is important to note that the makeup of an

HOV project planning team depends on specific project considerations and that the roles and responsibilities of participant groups often overlap.

- State Departments of Transportation
- Transit Agencies
- State and Local Police
- The State Department of Public Safety (DPS) or Department of Motor Vehicles (DMV)
- County and City Departments
- Metropolitan Planning Organizations (MPOs)
- Consultants and Contractors
- Toll Authorities
- Emergency Services
- Public Groups such as transit riders and commuters

Additional stakeholders such as rideshare agencies, bicyclists, neighborhood associations, businesses, schools, hospitals, and other entities also have a stake in the HOV planning process. Like public groups, these stakeholders contribute to HOV safety by raising issues of relevance to their constituents and providing input regarding facility planning and development.

- 6) How can metrics and performance monitoring techniques be used to evaluate HOV-lane programs and enhance safety?

Safety metrics applied at the planning level enable subsequent comparisons of “before-and-after” crash data and quantification of the safety impact of HOV-lane implementation. These data also provide valuable insight into whether a facility’s safety goals and objectives are being achieved, the underlying reasons for safety performance, and the potential need for design or operational changes to address adverse safety conditions or impacts. The establishment of a performance monitoring program and the collection of baseline safety data for a proposed HOV corridor should be undertaken years in advance of the start of HOV-lane construction. Safety should be monitored on a lane-by-lane basis so that distinctions in crash rates and traffic mix/flow characteristics can be accounted for in future data comparisons.

- 7) What bearing do facility type and design decisions have on safety?

The selection of a facility type and design can have a profound effect on the actions and safety of facility users. Crashes on HOV and HOT lanes occur due to the failure of users to successfully negotiate their environment. While this is sometimes due to driver issues such as inattention, impairment or violation of regulations, it can also be influenced by facility type and design considerations. Planning and design decisions influence the number, location and severity of crashes that occur on and around the facility. The process of designing an HOV

or HOT facility flows from the planning phase in which a specific facility type is selected. Design elements with the greatest potential to affect safety include:

- Lane and shoulder widths
- Provision and design of buffers
- Delineation and separation techniques
- Access treatments and signage
- Enforcement-site location and design

Positive traffic-flow separation provided by barrier-separated facilities offers critical safety advantages over buffer-separated and non-separated facilities. However, the operational characteristics of this facility type may not be appropriate for the proposed context or application. Further, the available envelope may be insufficient for construction of the desirable cross section. Where full design guidelines for a facility type cannot be adhered to, design exceptions, tradeoffs and compensatory measures may be employed. Such measures should be borne out through research or operator experience, and provide a higher level of facility safety than would otherwise exist.

8) What are some important elements in HOV-lane safety evaluation programs?

One of the primary elements in HOV-lane safety evaluations is the “before” and “after” safety analysis. Calculation of crash rates before and after the implementation of an HOV facility provides a means of measuring changes in crash potential relative to exposure in vehicle-kilometers or vehicle-miles traveled. Several years of crash data must be collected at the corridor and lane level to undertake this type of evaluation.

Ongoing HOV-lane safety evaluation programs may incorporate the following components, which are designed to function as a feedback for continuous enhancement of facility safety:

- Planning
 - Collect and maintain data
 - Identify hazardous locations and elements
 - Conduct engineering studies
 - Establish safety improvement priorities
- Implementation (design and construction) of improvement projects according to above prioritization
- Evaluation (post-construction data collection and analysis) to determine effectiveness of safety improvement projects and advance future safety efforts

9) What operational activities have the greatest impact on HOV-lane safety?

A number of HOV-lane operational activities can impact facility safety. These include:

- Lane Opening, Closing and Reversal
- Incident Management
- Enforcement Operations
- Data Collection

Attention should be paid to the procedures and equipment used to carry out these responsibilities so that safety risk to operational crews and facility users is minimized.

10) What are some of the unique safety-related issues and mitigation techniques associated with HOT facilities?

HOT-facility enforcement can be more complex and dangerous than HOV-lane enforcement. In addition to determining the number of occupants traveling in vehicles, officers may be required to verify the presence and validity of toll transponders. Verification of transponder existence/validity and vehicle occupancy can lead to officer distraction and increase the potential for vehicle-pedestrian collisions. The safety impact of tasking officers with multiple verification responsibilities can be mitigated through:

- Proper enforcement site design
- Appropriate signage
- Reduced enforcement zone speed limits
- Use of advanced toll transponder verification technologies

The driving environment on HOT facilities is also generally more sophisticated than that of other roadways. Motorists with no previous experience using these facilities may become confused by aspects such as:

- Eligibility and occupancy rules
- Toll transponder requirements
- Complex signage

Driver confusion and unfamiliarity with HOT-facility protocols can result in erratic maneuvers that endanger the safety of the driver, other motorists, and enforcement officers. Methods of reducing driver confusion and related safety issues on HOT facilities include:

- Clear, concise signage in advance of facility access points
- Public outreach and marketing campaigns apprise motorists of facility regulations, operation, and common safety issues

11) What areas of HOV and HOT-facility safety require further research?

The relationship between HOV/HOT-facility safety and the numerous variables that affect it is often poorly understood and requires further study. The following list of potential research topics highlights various needs, gaps, and opportunities associated with HOV and HOT-facility design, operations and safety:

- Countermeasures to Address Speed Differentials and Access Conflicts
- Human Factors in HOV and HOT-Lane Design and Safety
- Safety Considerations for HOT Facilities in Extreme Winter Conditions
- Improved Crash Reporting and Analysis Techniques
- Safety Implications of HOV/HOT Resentment Among Drivers in Mainlanes
- Effect of Speed Limits on HOV/HOT-Facility Safety
- Safety Considerations in Enforcement and Data Collection
- Use of Shoulder Rumble Strips to Mitigate HOV/HOT Run-Off-The-Road Crashes
- Use of Glare Screens to Reduce HOV /HOT Driver Distraction and Safety Issues
- Opening HOV Lanes to General-Purpose Traffic During Nights and Weekends
- Opening HOV Lanes to General-Purpose Traffic During Mainlane Incidents
- Use of Surrogates to Identify HOV/HOT Safety Deficiencies
- Safety Performance of Radial Versus Circumferential Facilities
- Safety Impact of Allowing Heavy Trucks on HOV Lanes
- Bicycle Use of Freeway HOV Lanes

